

Mandatory Greenhouse Gases Reporting Rule

Training



Agenda



- General rule requirements (applicability, reporting, monitoring, and recordkeeping), Q&A
- Stationary fuel combustion sources (including electricity generation)

Break (10:00)

- Municipal Solid Waste Landfills, Q&A
- General Q&A

Disclaimer



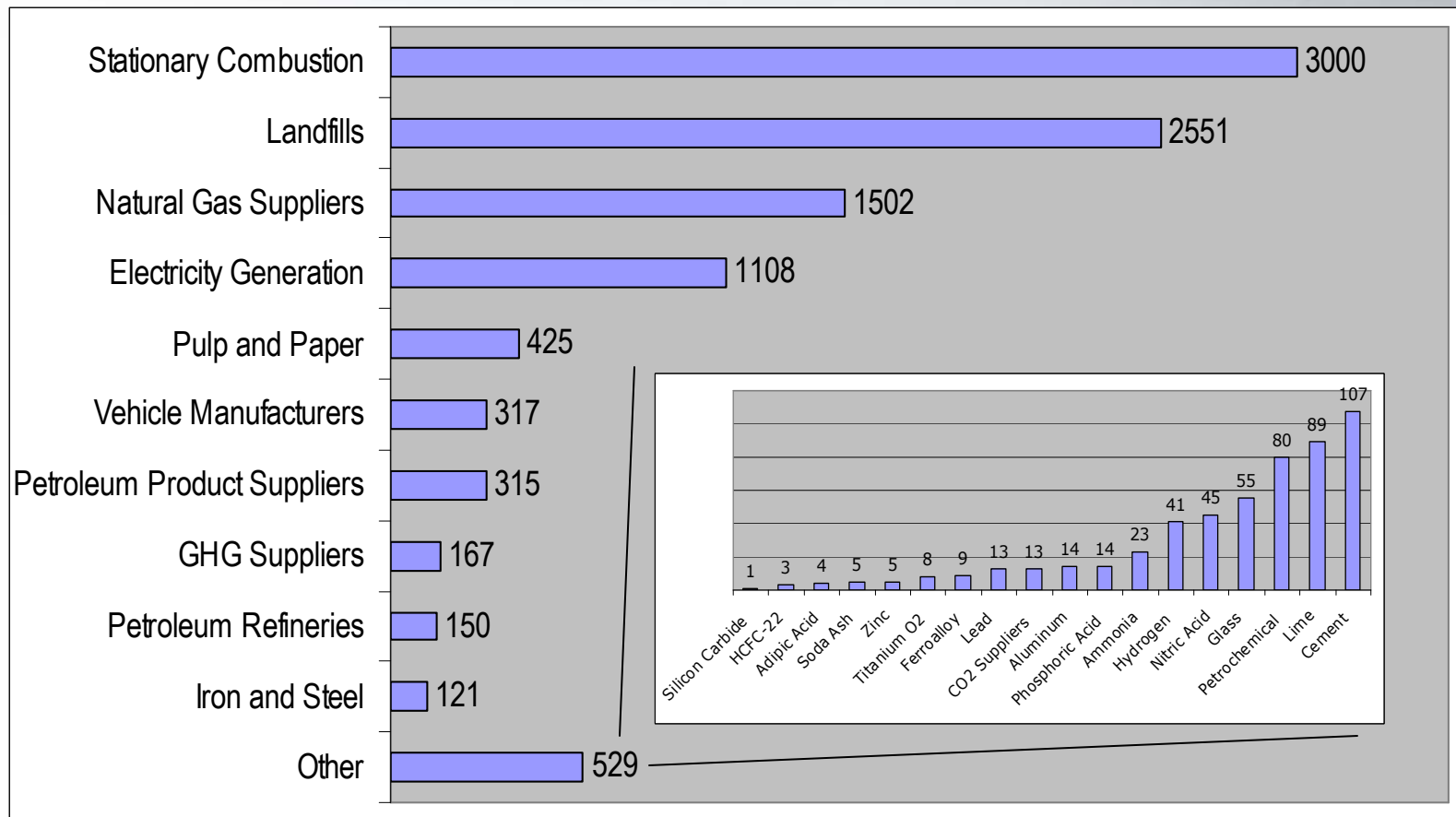
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Purpose of the Rule



- Provide accurate and timely data to inform future climate change policies and programs
 - Better understand relative emissions of specific industries, and of individual facilities within those industries
 - Better understand factors that influence GHG emission rates and actions facilities could take to reduce emissions
- Does not require control of GHG

About 10,000 U.S. Facilities Covered



Key Elements of the Rule



- Annual reporting of GHG by:
 - 25 source categories
 - 5 types of suppliers of fuel and industrial GHG
 - Motor vehicle and engine suppliers (except light duty sector)
- 25,000 metric tons CO₂e or more per year reporting threshold for most sources; capacity-based thresholds where feasible
- Direct reporting to EPA electronically
- EPA verification of emissions data

What GHGs are Reported?



- CO_2
- CH_4 (methane)
- N_2O (nitrous oxide)
- Fluorinated GHGs
 - HFCs (hydrofluorocarbons)
 - PFCs (perfluorocarbons)
 - SF_6 (sulfur hexafluoride)
 - Other fluorinated gases (except CFC and HCFC and gases <1 mm Hg @25° C)

What is CO₂e?



- GHGs have varying heat-trapping ability and atmospheric lifetimes.
- Global warming potential (GWP) is a metric used to compare emissions among GHGs.
- The GWP of CO₂ is 1.0, and the GWP of other GHGs are expressed relative to CO₂
 - For example, CH₄ has a GWP of 21. Each metric ton of CH₄ emissions would have 21 times as much impact on global warming (over a 100-year time horizon) as a metric ton of CO₂ emissions.
- Mass emissions x GWP = CO₂e (metric tons)

Table A-1 of Subpart A lists GWPs



Applicability

Applicability for Direct Emitters is Facility-based



A facility is defined as...

- Physical property, plant, building, structure, source, or stationary equipment;
- on contiguous or adjacent properties;
- in actual physical contact or separated solely by public roadway or other public right of way; and
- under common ownership or common control

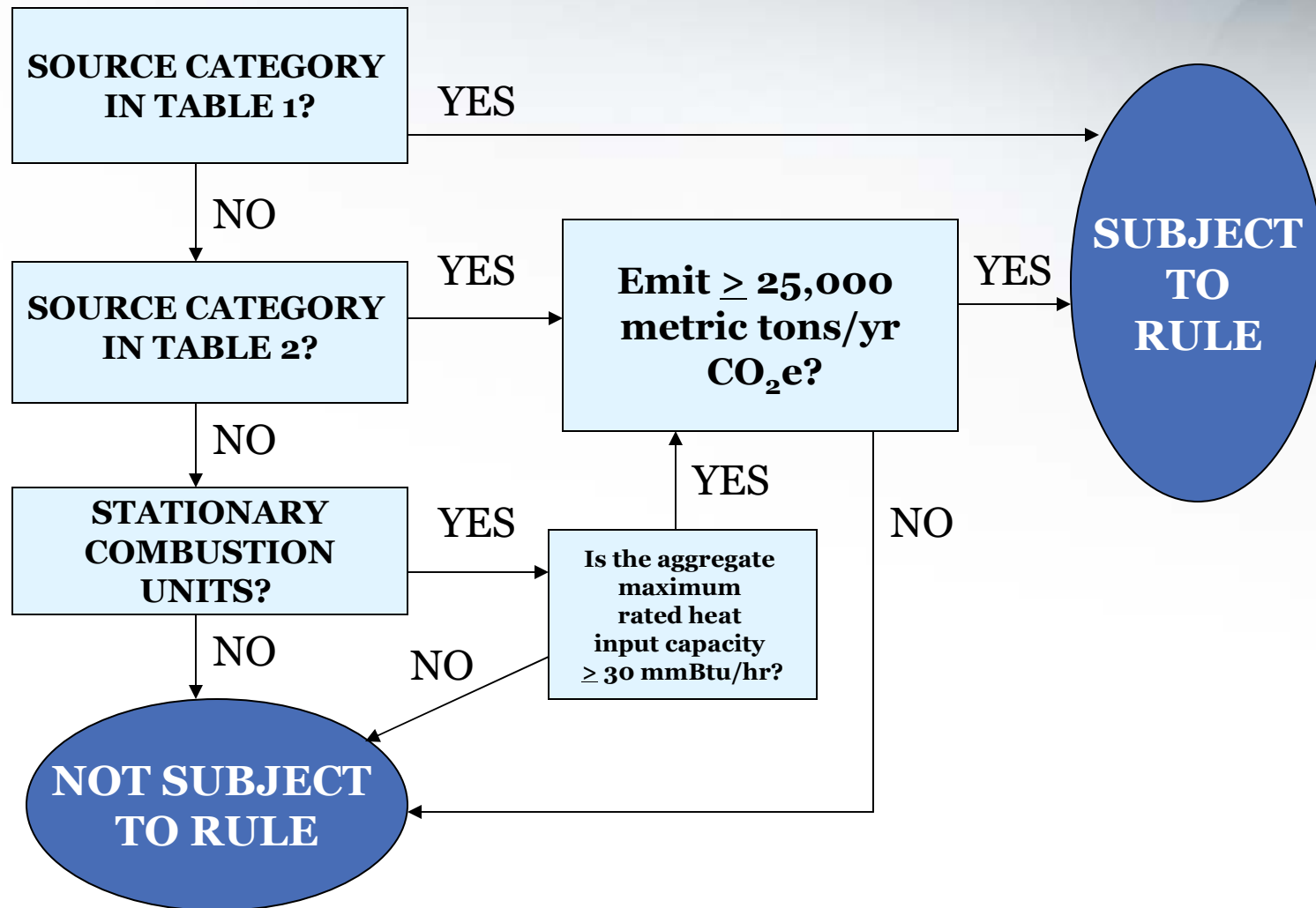
Military installations may be classified as more than one facility.

Assessing Applicability to the Rule



- Applicability criteria varies by source category.
- You must evaluate each source category to assess applicability to the rule.
- If rule applies to any source category, report emissions for all source categories for which methods are provided in the rule.

Does the Rule Apply to My Facility?



Does the Rule Apply to My Facility?

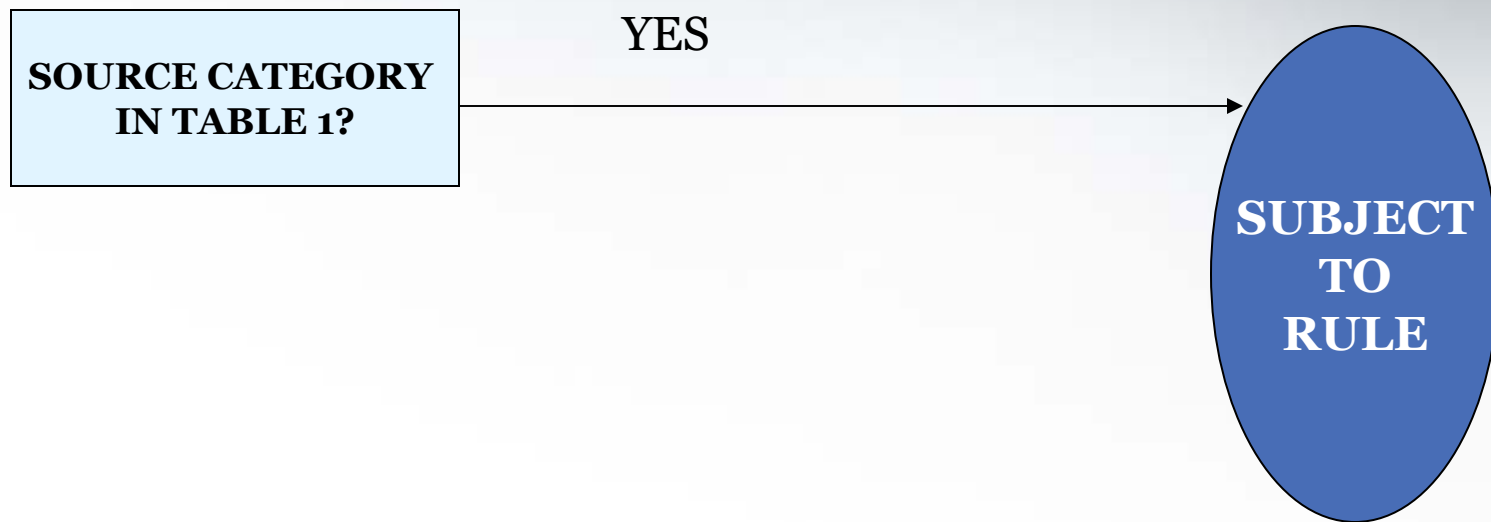




Table 1: All-in Source Categories*

Electricity Generation if report CO₂
year-round through Part 75

Adipic Acid Production

Aluminum Production

Ammonia Manufacturing

Cement Production

HCFC-22 Production

HFC-23 Destruction Processes that
are not collocated with a HCFC-22 production
facility and that destroy more than 2.14
metric tons of HFC-23 per year

Lime Manufacturing

Nitric Acid Production

Petrochemical Production

Petroleum Refineries

Phosphoric Acid Production

Silicon Carbide Production

Soda Ash Production

Titanium Dioxide Production

Municipal Solid Waste Landfills
that generate CH₄ equivalent to 25,000
metric tons CO₂e or more per year

Manure Management Systems
that emit 25,000 metric tons CO₂e or more
per year

[EPA will not be implementing the manure
management rule due to a Congressional
restriction prohibiting expenditure of
funds for this purpose]

*Source categories are defined in each subpart.

Does the Rule Apply to My Facility?

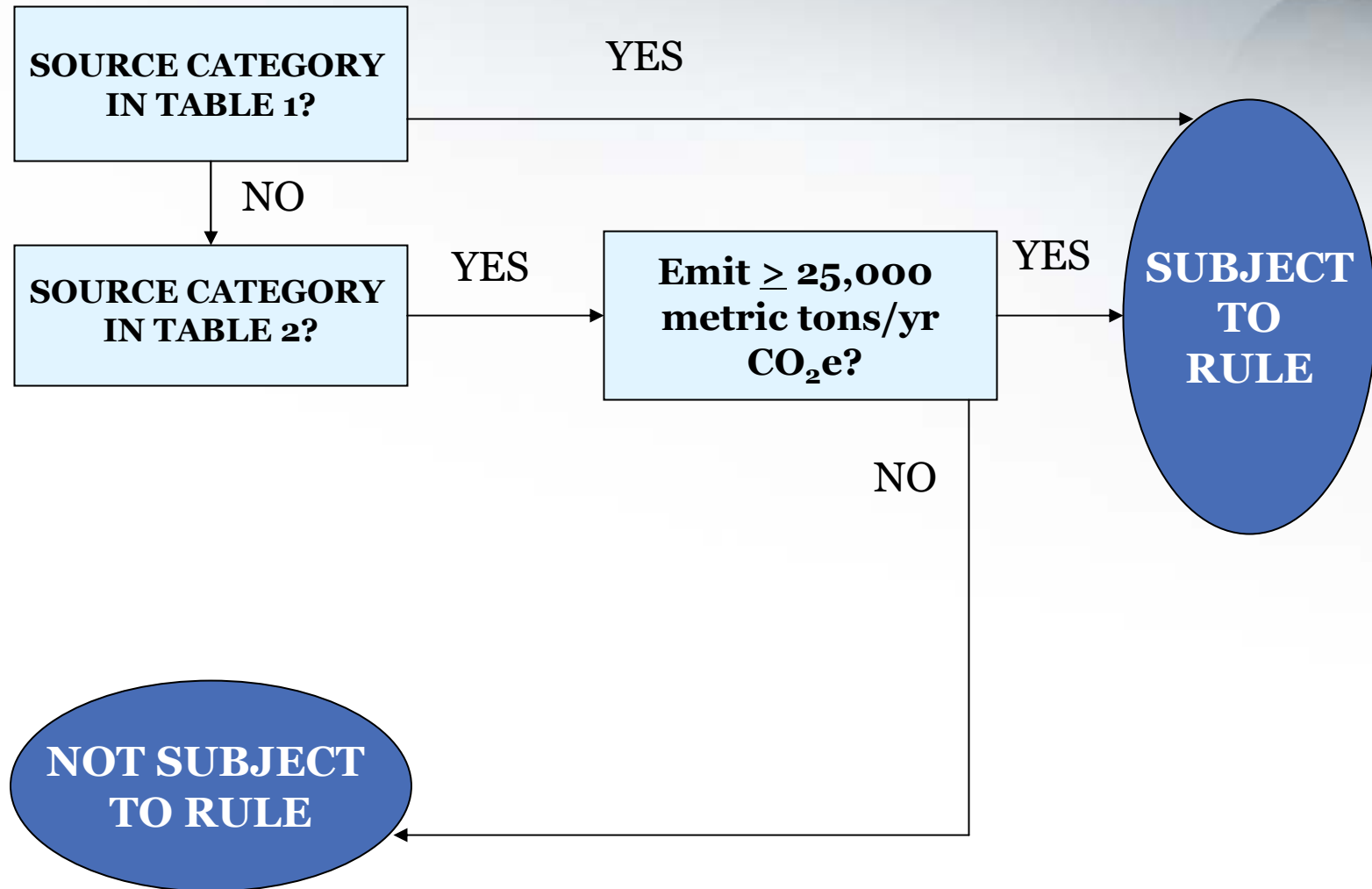




Table 2: Threshold Source Categories*

Ferroalloy Production

Glass Production

Hydrogen Production

Iron and Steel
Production

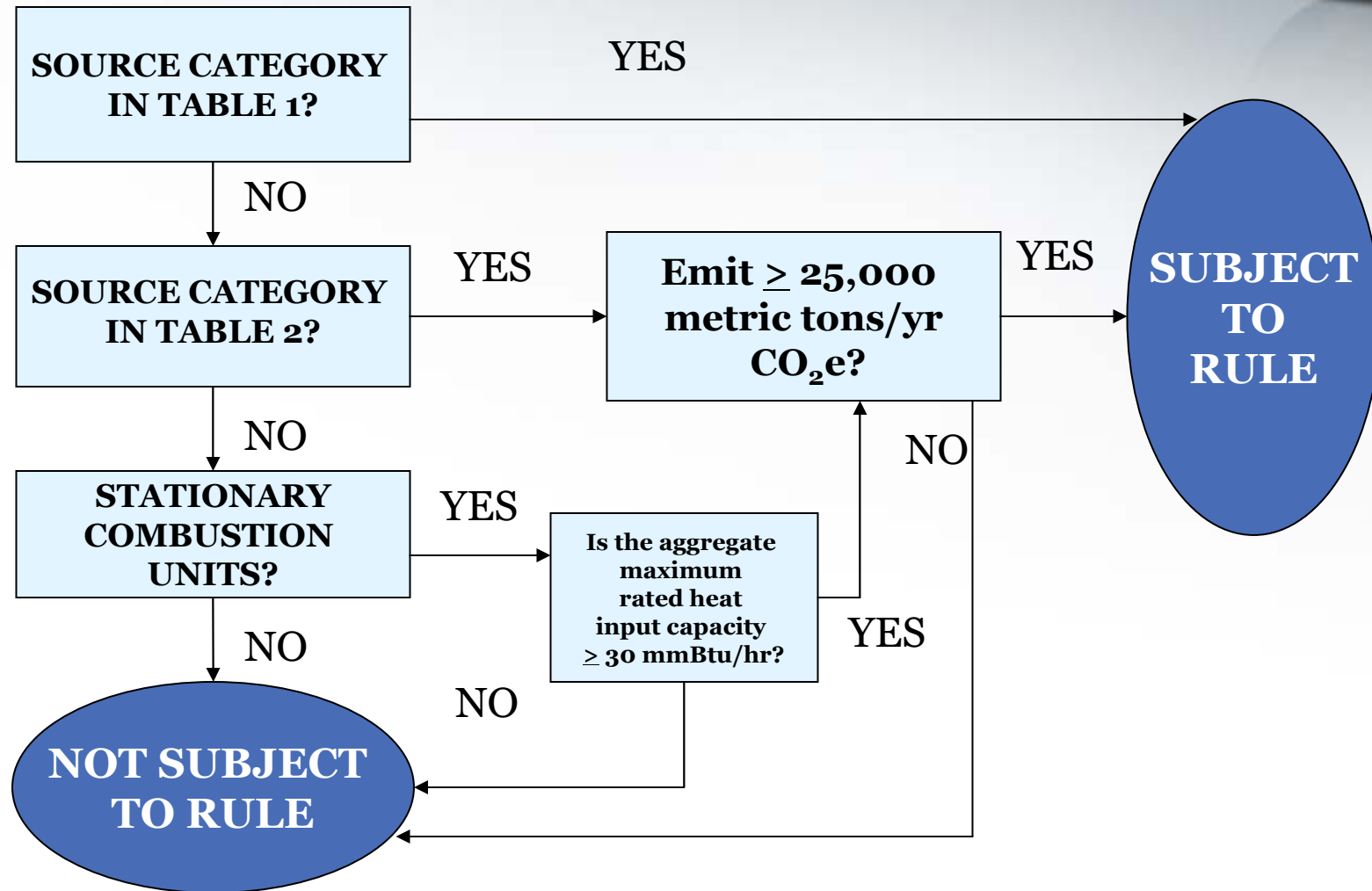
Lead Production

Pulp and Paper
Manufacturing

Zinc Production

* $\geq 25,000$ metric tons CO₂e per year from all source categories, combustion units, and miscellaneous use of carbonates.

Does the Rule Apply to My Facility?



What Combustion Units Will Emit 25,000 MT CO₂e per year?



Fuel	Design Capacity ¹ (mmBtu/hr)	Annual fuel Use
Coal	30	10,800 tons
Fuel Oil	35	2.3 million gallons
Natural Gas	50	460 million ft ³

¹Assuming full utilization and 8,760 hours/yr.

Applicability Example #1



Facility Description	Required to Report?	Explanation
A petrochemical plant emits 22,000 metric tons/yr CO ₂ e.	Yes	Because petrochemical manufacturing is a source category that is listed in Table 1, the facility must submit a report regardless of the amount of GHGs emitted.

Applicability Example #2



Facility Description	Required to Report?	Explanation
An automobile assembly plant emits 30,000 metric tons/yr CO ₂ e from a coal-fired boiler.	Yes	Automobile assembly plants are not a listed source category in Tables 1 or 2, but the facility nevertheless must submit a report because emissions from stationary fuel combustion are 25,000 metric tons/yr CO ₂ e or more.

Applicability Example #3



Facility Description	Required to Report?	Explanation
A university emits 24,000 metric tons/yr CO ₂ e from a cogeneration unit and 2,000 metric tons/yr CO ₂ e from coal storage.	No	Because the rule does not prescribe a method for calculating GHG emissions from coal storage, coal storage emissions are not counted in determining applicability.

Applicability Example #4



Facility Description	Required to Report?	Explanation
<p>A cheese manufacturing plant contains:</p> <ul style="list-style-type: none">• A gas-fired boiler that emits 15,000 metric tons/yr CO₂e,• A biomass-fired boiler that emits 10,000 metric tons/yr CO₂, and• A wastewater treatment operation that emits 10,000 metric tons/yr CO₂e.	No	Because food processing and wastewater treatment are not source categories listed in Tables 1 or 2, the facility must report only if emissions from stationary fuel combustion are 25,000 metric tons/yr CO ₂ e or more. Because combustion of biogenic CO ₂ is excluded from the applicability computation, nonbiogenic GHG emissions for the facility are 15,000 metric tons/yr CO ₂ e; and the facility is not required to report.

For more examples:

<http://www.epa.gov/climatechange/emissions/downloads09/generalprovisions.pdf>

Applicability Tool



To help determine if facilities must report...

- Check-off list of source categories
- Combustion calculator
- Municipal landfill calculator

<http://www.epa.gov/climatechange/emissions/GHG-calculator/index.html>

Source Categories Not Included in Final Rule



EPA plans to further review public comments and other information before deciding on these subparts:

- **Electric transmission and distribution equipment manufacturing**
- **Electronics manufacturing**
- **Ethanol production**
- **Fluorinated GHG production**
- **Food processing**
- **Magnesium production**
- **Petroleum and natural gas systems**
- **Use of electric transmission and distribution equipment**
- **Underground coal mines**
- **Industrial landfills**
- **Wastewater treatment**
- **Suppliers of coal**
- **Importers of pre-charged equipment and closed-cell foam products**
- **CO₂ injection and geologic sequestration**

Facilities with these source categories could be covered by the rule based on GHG emissions from stationary fuel combustion sources.

How Do I Estimate Emissions for Applicability Purposes?



- Estimate actual emissions
- Use applicable equations in the rule
- Monitoring data not required—use available company records
- Simplified methods allowed for combustion sources
- Include CO₂ transferred off-site
- Exclude CO₂ emissions from biomass combustion
- Exclude research and development activities
- Include an F-GHG only if listed in Table A-1 of rule

If you are close to 25,000 MT CO₂e/yr based on available records, it may be prudent to monitor.

What Suppliers Are Covered?



- All producers of:
 - Petroleum products
 - Coal-based liquids
 - Industrial GHGs (F-GHG and N₂O)
 - CO₂
- Exporters of 25,000 metric tons CO₂e per year or more
- Importers of 25,000 metric tons CO₂e per year or more
- Natural gas and natural gas liquids
 - All fractionators
 - All local gas distribution companies



Reporting, Monitoring, and Recordkeeping Requirements

What are the Reporting Requirements?



- Subpart A: General Provisions
 - Applicability provisions
 - Schedule
 - Reporting and recordkeeping requirements common to all reporters
 - Definitions
 - Report submission procedures
 - Other (e.g., calibration procedures, monitoring plan)
- Subparts C-PP: Source-Specific Requirements
 - Definition of source category
 - GHG to report
 - Calculation methods
 - Monitoring and QA/QC
 - Missing data procedures
 - Reporting and recordkeeping elements unique to each subpart

General Monitoring Approaches



- Continuous emission monitoring systems (CEMS)
 - Required if already used (e.g., NSPS, Acid Rain Program) and meet specified criteria
 - Optional for other sources
- Source category-specific GHG calculation methods
 - Monitor process parameters, fuel use
 - Calculate GHG using equations in applicable subparts
 - Example approaches (varies by source category)
 - Mass balance calculation
 - Site-specific emission factors
 - Default emission factors

Special Provisions for 2010: Best Available Monitoring Methods



- Best available monitoring methods may be used during January 1, 2010 through March 31, 2010
 - Use emission estimation equations provided in the rule
 - Obtain equation inputs using best available monitoring method (e.g., current monitoring methods, engineering calculations, company data)
- Must begin following all applicable monitoring and QA/QC requirements on April 1, 2010 unless an extension is approved by EPA
- If an extension was needed (equipment purchase, process unit shutdown etc.), facility could request an extension.
 - Extension request must have been submitted to EPA no later than January 28, 2010.
 - No extension beyond December 31, 2010

Special Provisions for 2010: Abbreviated Emissions Report



- Available to facilities with only stationary combustion sources, and no other listed source categories
- Can report total facility emissions only (not unit level)
- Can use any calculation methodology in Subpart C

Schedule for Monitoring and Reporting



1/1/10	Start collecting data using required methods in each subpart or best available monitoring methods
1/28/10 (30 days after rule effective date)	Deadline for submitting application to extend use of best available monitoring methods
3/31/10	Monitors installed and calibrated Begin using required monitoring methods (if extension for best available methods not obtained)
12/31/10	Complete 2010 data collection
1/30/11	Submit certificate of representation
3/31/11	Submit GHG report for 2010
Ongoing	Submit corrected report 45 days after each discovery
Ongoing	Submit annual reports on 3/31 each year

What Do Facilities Report?



- Identifying information
- Annual GHG emissions excluding biomass CO₂, metric tons CO₂e
- Annual CO₂ emissions from biomass combustion, metric tons
- Annual emissions of each GHG for each source category, metric tons each gas
- Other emissions data required by an applicable subpart (e.g., by unit or process line)
- Verification data required by each subpart (e.g., data used to calculate emissions)
- Description of best available methods used
- Data elements for which a missing data procedure was used
- Certification by the “designated representative”

What Do Suppliers Report?



- Identifying information
- Annual quantity from all supply categories, metric tons CO₂e
- Annual quantity from each supply category, metric tons of each gas
- Other data required by an applicable subpart
- Verification data required by each subpart
- Description of best available methods used
- Data elements for which a missing data procedure was used
- Certification by the “designated representative”

What Is Not Reported?



- Indirect emissions (e.g., electricity use)
- Mobile source emissions (e.g., fleet emissions, off-road equipment)
- Emission offsets
- Carbon sequestration

Retain These Records for 3 Years:



- List of all units, operations, processes, and activities for which GHG emission were calculated
- All data used to calculate the GHG emissions for each unit, operation, process, and activity, categorized by fuel or material type
- The annual GHG reports
- Missing data computations
- Written GHG Monitoring Plan
- Certification and QA tests
- Maintenance records for measurement equipment
- Other data required by applicable subparts

Monitoring Plan



- Identifies responsibilities (i.e., job titles) for data collection
- Explains processes and methods used for data collection
- Describes QA/QC procedures for monitors
- May rely on references to existing corporate documents (e.g., existing QA plans, standard operating procedures)

General Monitor Calibration Requirements [40 CFR 98.3(i)]



- Applies to flow meters and other measurement devices
- Calibrate to 5% accuracy
- Use manufacturer's specifications, industry consensus standard, or method in rule subpart
- Calibrate by 04/01/2010 unless:
 - previous calibration is still valid
 - calibration would require a maintenance outage

General Monitor Calibration Requirements (cont.)



- Fuel billing meters generally exempt
- Source category subparts can override 98.3(i) for:
 - calibration accuracy
 - initial calibration date
- Some subparts allow use of “company records”
 - 98.3(i) doesn’t apply to monitors used as “company records”
 - document calibration procedures in monitoring plan

When Can I Stop Annual Reporting?



- If annual reports demonstrate CO₂e <25,000 metric tons/yr for 5 consecutive years.
- If annual reports demonstrate CO₂e <15,000 metric tons/yr for 3 consecutive years.
- If you shut down all processes/units/supply operations covered by the rule.

How Will Emissions Be Verified?



- Self certification
 - Designated representative certifies and submits report
 - Rule allows one designated representative for each facility and supplier
- EPA verification
 - Reports submitted through an electronic system
 - Built-in calculation and completeness checks for reporters
 - Electronic QA and consistency checks
 - On-site audits

Electronic Data Reporting System



- Electronic format and system under development
- Web-based system
 - Will guide reporters through data entry and submission
 - Built-in emissions calculations
- Mechanism to submit file directly using standard format (e.g., XML)
- Continued stakeholder input during system development
- Outreach, training, and hotline to assist reporters using the system

Confidential Business Information (CBI)



- EPA will protect any information claimed as CBI in accordance with regulations in 40 CFR Part 2, subpart B
- In general, emissions data collected under CAA sections 114 and 208 cannot be considered CBI
- EPA will undertake a separate notice and comment process in 2010 on CBI status of data collected.

Relationship to State and Regional Programs



- Rule does not preempt states from regulating or requiring reporting of GHGs.
 - EPA rule is a limited action developed in response to a specific request from Congress and is narrower in focus than many existing State programs that are coupled with reduction programs
- No state delegation
- Reporting entities will report directly to EPA
 - To reduce reporting burden, EPA staff is working with the Climate Registry and the Exchange Network on a data exchange standard
 - EPA is committed to working with state and regional programs to provide timely access to verified emissions data, establish mechanisms to share data efficiently, and harmonize data systems to the extent possible

Mobile Source Requirements



- Emissions from mobile sources will be captured by reports from fuel suppliers and manufacturers of vehicles and engines (outside of the light-duty sector).
- No requirements for fleet operators or state and local governments.
- Manufacturers of vehicles and engines—including heavy-duty trucks, motorcycles, and nonroad engines—will report CO₂ starting with model year 2011 and other GHGs in subsequent model years.

Mobile Source Requirements (continued)



- Rule amends existing mobile source regulations to integrate GHG reporting into long-standing criteria emissions testing and certification programs.
 - Emissions reported as a rate (e.g. grams per unit of work) using existing test procedures in most cases.
 - Manufacturers report by model year at time of current annual certification.
 - Small manufacturers are generally exempt from new reporting requirements.
 - Requirements for new testing of CH₄ and N₂O may be waived if manufacturers provide appropriate, alternative data.

Additional Information



www.epa.gov/climatechange/emissions/ghgrulemaking.html

- Information sheets and monitoring checklists for each subpart
- FAQs (by topic areas)
- Preamble and rule
- Technical background documents on source categories
- Comment response documents
- Training and Webinar schedule
- Other technical assistance materials (e.g. applicability tool)
- Hotline

Hotline



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For general questions about the final Mandatory Reporting of Greenhouse Gases Rule, please refer to the [Frequently Asked Questions](#) page. Additional resources, including information sheets, checklists, and technical support documents for each subpart of the rule are available through the [Resources by Subpart](#) page.

EPA is also operating a hotline for general and administrative questions about the rule. The hotline can be accessed via phone at 1-877-GHG-1188 or through the [Contact Us](#) page.

Additional information related to the rule will be posted on this site as it becomes available.

Resources and Tools

- [BAMM Petition Form \(PDF\)](#) (5 pp, 30K, [About PDF](#))
- [Special Provisions 2010 Fact Sheet](#) (6 pp, 55K, [About PDF](#))
- [Frequently Asked Questions](#)
- [Applicability Tool](#)
- [Power Point Presentation of the Mandatory Reporting of GHG Rule \(PDF\)](#) (31 pp, 273K, [About PDF](#))
- [Information Sheets/Checklists for Source Categories](#)
- [Technical Support Documents](#)
- [General Fact Sheet \(PDF\)](#) (3 pp, 35K, [About PDF](#))
- [Major Changes to the Rule Since Proposal \(PDF\)](#) (1 p, 46K, [About PDF](#))
- [Press Release, 9/22/09](#)

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You can find answers to a number of questions on the final Rule [Web site](#), especially the [Frequently Asked Questions page](#) and the information sheets for each of the source categories covered under the Rule. If you have further questions about the Rule or the rulemaking process, please contact us via the form below.

For media or press inquiries, please visit [EPA's Media Contacts](#) site for more information.

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Questions?



Stationary Fuel Combustion Sources Subpart C

What Units are Covered?



- Devices that combust solid, liquid, or gaseous fuel for:
 - producing electricity, generating steam, or providing useful heat or energy for industrial, commercial, or institutional use, or
 - reducing the volume of waste by removing combustible matter
- Examples:
 - Boilers
 - Stationary Internal Combustion Engines
 - Process Heaters
 - Combustion Turbines
 - Incinerators
 - Other Stationary Fuel Combustion Equipment (e.g. control devices)
- Covers any fuel combustion device, unless specifically exempted

Subpart C does not apply to:



- Portable equipment
- Emergency generators and emergency equipment
- Agricultural irrigation devices
- Flares, unless otherwise required by another subpart
- Electricity Generating Units subject to subpart D
- Hazardous waste combustion (co-fired fossil fuels only)
- Pilot fuels

What GHGs are Reported?



- CO₂ from fossil fuel and biomass
 - Four different methods (Tiers) for calculating CO₂ emissions
 - Different tiers used based on unit size, fuel type, other factors
 - Separately estimate CO₂ from sorbent used for acid gas control (unless CO₂ is measured with CEMS)
- CH₄ and N₂O
 - Emission factors

CO₂ Emission Calculation Tiers



Tier	For this fuel...	Measure these parameters...	And use a default factor for...
1	55 fuels ¹	Annual fuel use	HHV CO ₂ emission factor
2	55 fuels ¹	Annual fuel use HHV	CO ₂ emission factor
	MSW	Steam generation	CO ₂ emission factor
3	Solid/liquid	Annual fuel use Carbon content	--
	Gas	Annual fuel use Carbon content Molecular weight	
4	All	CO ₂	--

¹Any of the 55 fuels listed in Table C-1 of subpart C, except MSW units that generate steam.

Tier 1 Monitoring –Fuel Use



Use “company records”

- Direct measurements of fuel consumption by gravimetric or volumetric means
- Tank drop measurements
- Engineering calculations (e.g., using generation or unit operating hours)
- Fuel billing records
- Other

Must maintain records of methods used

Tier 2 Monitoring - HHV



- Fuel use
 - Company records
- High heating value of fuel. Minimum sampling frequency:
 - Natural gas: Semiannual
 - Coal and fuel oil: Each fuel lot (shipment or delivery)
 - Other liquid fuels, fossil fuel-derived gas fuels, and biogas: Quarterly
 - Other solid fuels and MSW: Weekly sample and monthly analysis

Tier 3 Monitoring – Fuel Carbon Content



- Fuel use
 - Solid fuel: Company records
 - Liquid fuel: Flow meter, billing meter, or tank drop measurements
 - Gaseous fuel: Flow meter or billing meter
- Minimum fuel sampling frequency (carbon):
 - Same as for Tier 2, except
 - Other gaseous fuels: Daily (if equipment in place) or weekly

Tier 4 Monitoring (CEMS)



- Install CO₂ and volumetric flow rate monitor
 - O₂ monitor may be used in some situations
 - Calculate hourly mass emission rates
 - Sum to quarterly and annual emissions
- Three alternatives: Use reported annual heat input and part 75 equations [98.33(a)(5)]

Use of Tier 1 (measure fuel use only)



Tier 1 may be used in 3 situations:

- Unit ≤ 250 mmBtu/hour and fuel listed in Table C-1 (55 fuels)
- Municipal solid waste (MSW) unit that does not produce steam
- Biomass in unit of any size

Exception: If HHV data are available at the minimum required frequency, Tier 2 must be used.

Use of Tier 2 (measure HHV)



Tier 2 may be used in 3 situations:

- Unit ≤ 250 mmBtu/hour and fuel listed in Table C-1 (55 fuels)
- Pipeline natural gas and/or distillate fuel oil in unit of any size
- MSW unit that produces steam

Use of Tier 3 (measure carbon content)



Tier 3 must be used in 2 situations:

- Unit > 250 mmBtu/hour for any fuel listed in Table C-1, except:
 - Pipeline natural gas, distillate fuel oil, and biomass fuels
 - MSW
 - If Tier 4 is required
- Unit > 250 mmBtu/hour and a fuel not listed in Table C-1, only if:
 - The fuel provides 10% or more of annual heat input to the unit, and
 - Tier 4 is not required

Use of Tier 4 (CEMS)



For large units, required if ALL six requirements are met:

1. Unit has CEMS that is required by regulation or permit.
2. Unit >250 mmBtu/hr, or >250 tons per day of MSW.
3. Solid fossil fuel or MSW is primary or secondary fuel.
4. Unit operated $>1,000$ hours in any calendar year since 2005.
5. CEMS has a gas monitor of any kind or a stack gas volumetric flow rate monitor
6. Monitors undergo periodic QA testing under part 75, NSPS, or State program.

Use of Tier 4 (CEMS)



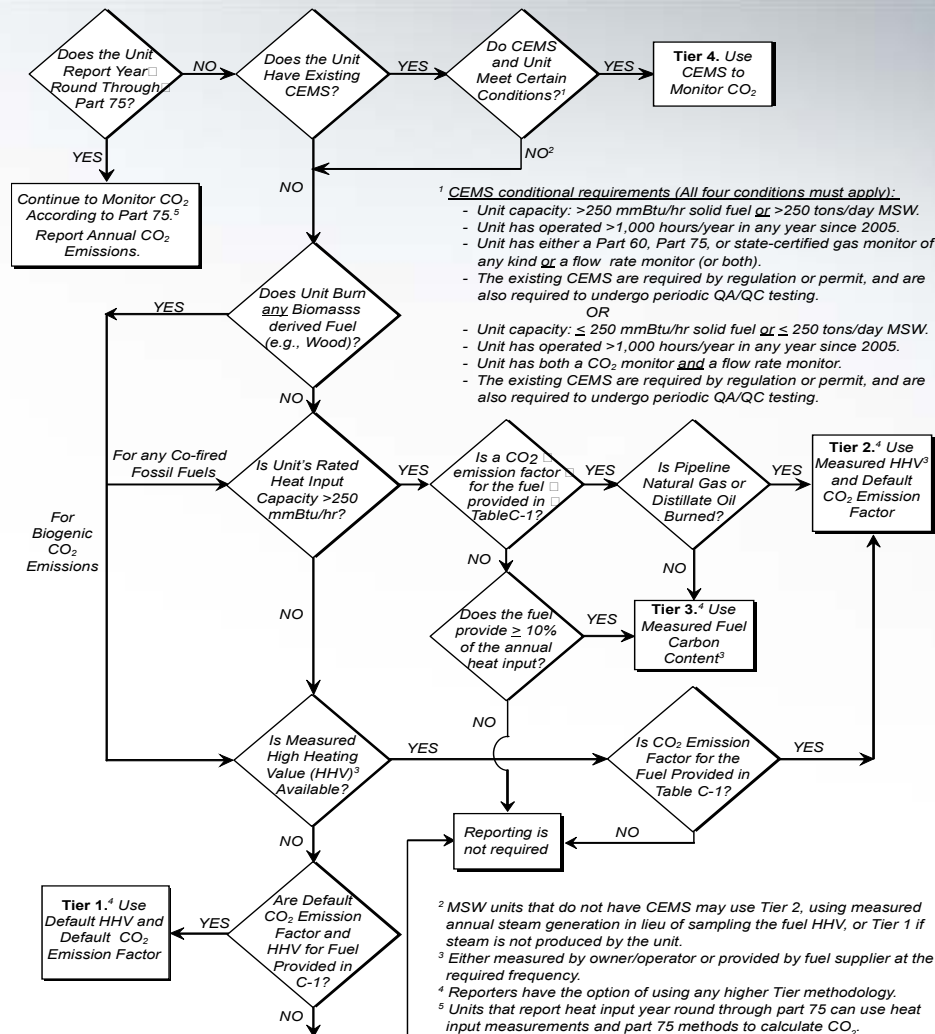
For small units, required if ALL six requirements are met:

1. Unit has CEMS that is required by regulation or permit.
2. Unit ≤ 250 mmBtu/hr, or ≤ 250 tons per day of MSW.
3. Solid fossil fuel or MSW is primary or secondary fuel.
4. Unit operated $>1,000$ hours in any calendar year since 2005.
5. CEMS has a CO₂ monitor and a stack gas volumetric flow rate monitor
6. Monitors undergo periodic QA testing under part 75, NSPS, or State program.

How the Tiers Work...



General Stationary Fuel Combustion Requirements for CO₂ 40 CFR 98 Subpart C

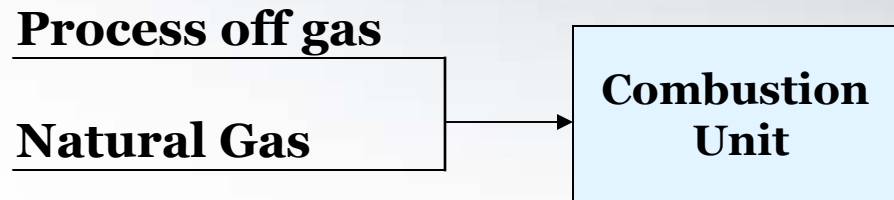


Thermal Oxidizers/Control Devices



- Hazardous Wastes
 - Use CEMS if required by another rule
 - Otherwise, report only fuels listed in Table C-1
- Units ≤ 250 MMBtu/hour
 - Report only fuels listed in Table C-1
- Units > 250 MMBtu/hour
 - Report only fuels listed in Table C-1, and
 - Any other fuel that provides $> 10\%$ annual heat input to the unit

Control Devices - Example



- Units ≤ 250 MMBtu/hour
 - Tier 1 for natural gas
 - Process off gas not reported
- Units > 250 MMBtu/hour
 - Tier 2 for natural gas
 - Tier 3 for process off gas, if $> 10\%$ of annual heat input

Mixed Fuel



Pre-mixed Fuel

**Combustion
Unit**

- Table C-1 fuels – use appropriate Tier method for each fuel
- Non-Table C-1 fuels
 - units ≤ 250 MMBtu/hour – reporting not required
 - units > 250 MMBtu/hour – use Tier 3

Fuel A

Fuel B

**Combustion
Unit**

- Use appropriate tier for each fuel.

What Must be Reported?



- CO₂, N₂O, and CH₄ from fossil fuel and biomass
- Reporting is at unit level (each fuel) with some exceptions:
 - Aggregate units ≤ 250 mmBtu/hr
 - Aggregate units served by common pipe
 - Aggregate units sharing common stacks using CEMS
- Verification data specified at §98.36(e)

Requirements for Biomass



- Biomass CO₂ emissions not considered in applicability, but are reported if subject to rule
- Estimate biogenic CO₂ emissions only for fuels listed in Table C-1, unless CEMS is used:
 - Wood and Wood Residuals
 - Agricultural Byproducts
 - Peat
 - Solid byproducts
 - Biogas
 - Ethanol
 - Biodiesel
 - Rendered Animal Fat
 - Vegetable Oil
- CH₄ and N₂O emissions are considered in applicability and reported

Calculating Biogenic CO₂ from Mixed Biomass and Fossil Fuels



- If no CEMS
 - Tier 1 Calculation Method and company records for amount of biomass combusted
- If use CEMS
 - Equations using F-factors, or
 - ASTM D7459-08 and D6866-06a (quarterly)
- If burning MSW,
 - Tier 1 or 2 (as applicable)
 - ASTM D7459-08 and D6866-06a (quarterly)

CH₄ and N₂O Calculation Methods



If you use this Tier for CO ₂	Measure these parameters ¹	And use a default factor for
Tier 1 or Tier 3	Annual fuel use (Eq.C-8)	HHV CH ₄ emission factor N ₂ O emission factor
Tier 2 Fuel Option	Annual fuel use HHV (Eq. C-9a)	CH ₄ emission factor N ₂ O emission factor
Tier 2 Steam Option	Annual steam generation MMBtu/lb steam output (Eq.C-9b)	CH ₄ emission factor N ₂ O emission factor
Tier 4	Annual heat input (Eq.C-10)	CH ₄ emission factor N ₂ O emission factor

¹Use same values as used for CO₂ calculations



What is Reported for Each Unit?

- Unit identification number
- Type of unit (code)
- Rated capacity
- Each fuel type burned
- Tier methodology used for CO₂
- For Tier 1-3 (for each fuel)
 - CO₂ emissions in tons
 - CH₄ and N₂O emissions in tons and CO₂e
- For Tier 4
 - CO₂ emissions for all fossil fuels combined
 - CO₂ emissions for all biomass fuels combined
 - CH₄ and N₂O emissions for each fuel (tons and CO₂e)
- CO₂ sorbent emissions (if not using CEMS)
- Customer meter number for natural gas
- Verification data



Electricity Generation

Subpart D

Applicability



- Electric generating units (EGUs) subject to the Acid Rain Program
- EGUs subject to Part 75 for monitoring and reporting CO₂ emissions year round
- Excludes:
 - portable equipment
 - emergency generators
 - emergency equipment

How Does the MRR Affect Your Part 75 Reporting?



- Same monitoring
- Same QA requirements
- Same reporting
- Same schedule

What is Reported Under MRR?



Annual CO₂, CH₄, and N₂O emissions (metric tons/year) from:

- EGUs that report year round through part 75
- All other EGUs
- All other stationary combustion units at the facility
- Any other applicable source category in part 98

How do I Calculate GHG Emissions?



- Part 75 units
 - Convert 4th quarter part 75 CO₂ emissions to metric tons/year
 - Follow 98.33(c)
 - Eq. C-10 in subpart C for CH₄ and N₂O emissions (uses cumulative heat input reported under part 75)
- EGUs not reporting through part 75 and other stationary combustion units
 - Use appropriate Tier method in subpart C

Missing Data Requirements



- ARP units and units that report through part 75 must follow part 75 for:
 - CO₂ concentrations
 - Stack gas flow rate
 - Fuel flow rate
 - HHV
 - Fuel carbon content
- All other combustion units must follow subpart C

Report Content for Part 75 Units



- Follow requirements of 98.36(d):
 - Unit or stack identification number
 - Annual CO₂ for all fuels combined
 - Part 75 methodology used for CO₂
 - Annual CH₄ (metric tons of CH₄ and CO₂e)
 - Annual N₂O (metric tons of N₂O and CO₂e)
 - Other data for units using the alternative CO₂ calculation methods
- If units are aggregated, follow 98.36(c)(2) or (c)(3)

Additional Information



www.epa.gov/climatechange/emissions/ghgrulemaking.html

- Applicability tool
- Preamble and rule
- Technical background documents for subpart C and D
- Subpart C and D comment response documents
- FAQs



Questions?



MSW Landfills

Subpart HH

Agenda



- Applicability
- GHGs reported
- Emissions calculation and monitoring methods
- Reporting and recordkeeping
- Questions

Which landfills must report?



- Municipal solid waste landfills
 - Definition in 40 CFR 98.6
 - Excludes C&D, industrial, and hazardous waste landfills
 - Industrial landfills may be added to the rule for future years
- Accepted waste since January 1, 1980
 - Covers both open and closed MSW landfills
- Methane generation $\geq 25,000$ metric tons CO₂e/yr
 - Applicability based on generation, not actual emissions

How do I determine applicability?



- Applicability is based on equations in the rule
- EPA on-line Applicability tool may be used for screening purposes
 - <<http://www.epa.gov/climatechange/emissions/GHG-calculator/index.html>>
 - Includes a simplified calculator for screening
- If methane generation is close to 25,000 metric tons CO₂e for 2010, perform more detailed calculations
 - Use equations in the rule
 - Use available data as input to the equations to estimate 2010 generation.

Which equations do I use to determine applicability



Landfills without gas collection systems (GCS)	Combination of Eq. HH-1 (Gas generation model equation similar to LandGEM) AND Eq. HH-5 (Adjusts HH-1 modeled generation for soil oxidation)
Landfills with GCS Use 2 methods. If either result exceeds threshold, the landfill must report	Method 1. Same as above
	Method 2. Combination of Eq. HH-4 (calculates methane recovery from measured GCS flow and CH ₄ concentration) AND Eq. HH-7 (calculates generation using methane recovery from HH-4 and assumed gas collection efficiency, and adjusts for soil oxidation)

Note: IPCC model or LandGEM can be used to calculate Eq. HH-1 using site-specific annual waste quantities and default values from Table HH-1.

GHGs to report



- Report 3 items:
 - CH₄ generation and emissions from the landfill (HH)
 - CH₄ destruction from collection and combustion (HH)
 - CH₄, CO₂ and N₂O from combustion devices (reported under subpart C)
- What to I report for landfill flares?
 - Subpart HH calculations and reporting includes CH₄ destruction in flares and CH₄ emitted from flares
 - CO₂ and N₂O from flares is not reported under HH or C

Who reports emissions from LFG-fired engines, boilers, etc.?



- “Facility” = contiguous or adjacent property under common ownership or common control (see full definition in 98.6)
- If the landfill and combustion devices are part of a single “facility”, submit single report with:
 - CH₄ generation and emissions from the landfill (including CH₄ emitted by combustion devices)
 - CH₄ destruction from gas collection and combustion system
 - CO₂, CH₄, and N₂O emissions from combustion devices under subpart C. (CO₂ and N₂O for LFG, all 3 pollutants for fossil fuels)

Who reports emissions from LFG-fired engines, boilers, etc. (continued)?



- If the landfill and the combustion devices are at separate facilities:
 - Landfill facility reports CH₄ generation and emissions from the landfill; CH₄ destruction (For gas sent off-site for destruction, assume DE=1).
 - Facility with the combustion devices reports emissions of CO₂, CH₄, and N₂O using subpart C methods *if* their facility is subject to the rule. (Can use table C-1 “biogas” default factors for LFG.)

How do I calculate emissions if I don't have a gas collection system?



Landfills without GCS use Eq. HH-5:

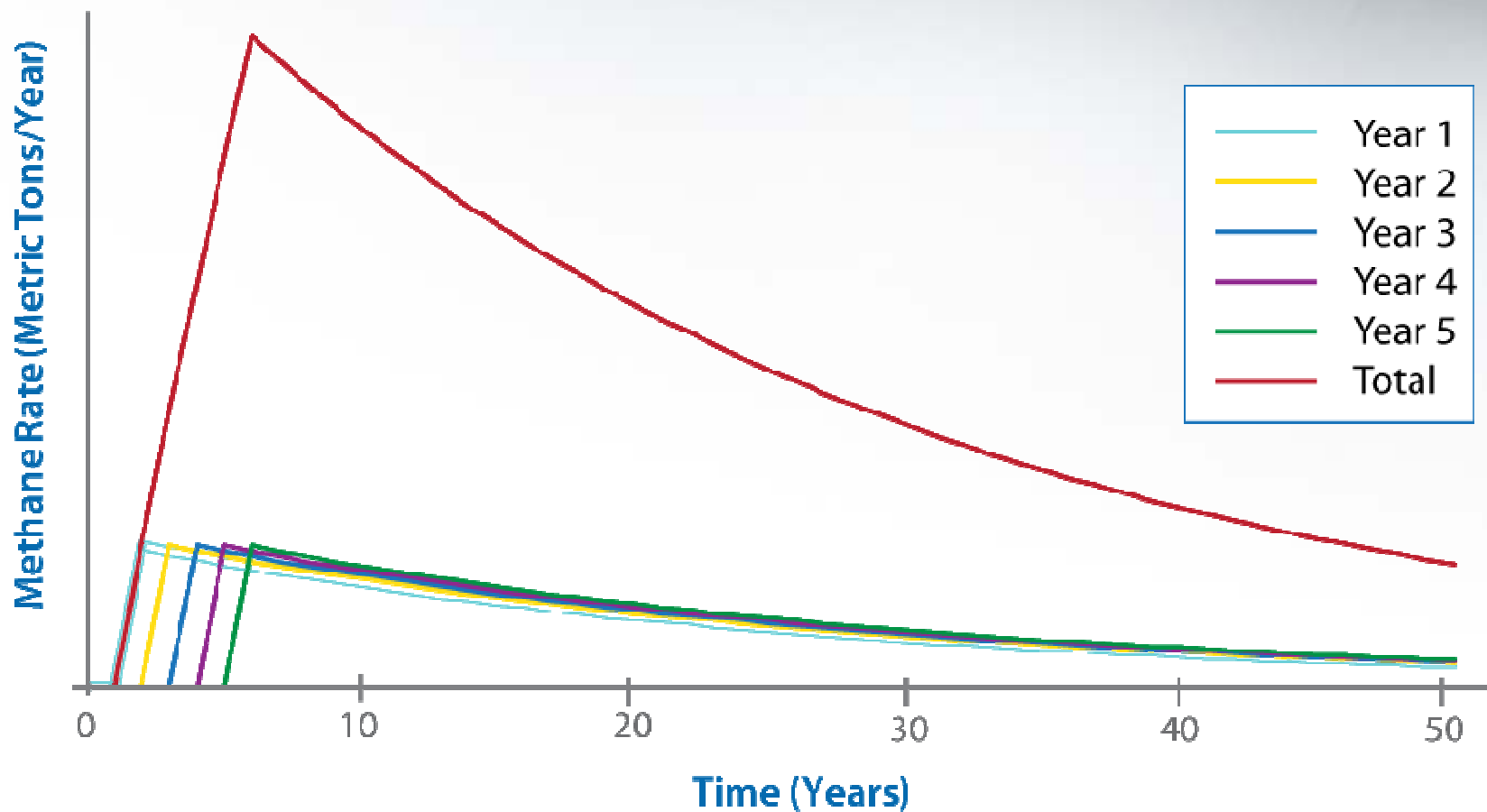
$$\begin{array}{ccccc} \text{Methane} & & G_{CH_4} \text{ (modeled} & & (1 - OX) \\ \text{emissions and} & & \text{methane} & & \text{Where } OX = 10\% \\ \text{methane} & = & \text{generation from} & \times & \text{soil oxidation} \\ \text{generation} & & \text{Eq. HH-1)} & & \text{factor} \end{array}$$

Eq. HH-1. First order decay model

$$G_{CH_4} = \left[\sum_{x=S}^{T-1} \left\{ W_x L_{0,x} \left(e^{-k(T-x-1)} - e^{-k(T-x)} \right) \right\} \right]$$

If waste composition is known, calculate using material specific L_0 and k . Otherwise, use bulk waste factors in rule table HH-1.

Methane Generation Curve for 5 Years of Waste



Data needed for Eq. HH-1 (modeled methane generation):



Must determine or measure	In units of	Using the following methods
S = Start year of calculation (year LF opened or 50 yrs ago)	NA	Available records
W _x = quantity of waste disposed in year X (for each year since start year of calc)	Metric tons, as received (wet waste)	For years prior to 2010, use tipping fee receipts or other records. For prior years for which quantities not available, estimate W _x using one of 3 methods: 1) Assume all prior years are the same as the first year for which waste data are available 2) Eq. HH-2: calc for each year based on population served, per capita waste generation, and percent landfilled 3) Eq. HH-3: use a constant annual average calculated from landfill capacity and number of years waste was received
	For 2010 and future years	Use mass measurement equipment meeting the requirements for commercial weighing equipment as described in NIST Handbook 44.
L _o = CH ₄ generation potential	Metric tons CH ₄ /metric ton waste	Use default for bulk waste in table HH-1 OR calculate for material-specific L _o values from MCF (methane correction factor), DOC (degradable organic carbon from Table HH-1) and Fraction by volume of CH ₄ in landfill gas (measured or assume 0.5)
k = Rate constant	Yr ⁻¹	Use bulk waste or material-specific default values from table HH-1 (unless measured values are available)

How do I calculate emissions if I have a gas collection system?



- Calculate emissions in two ways and report *both* results:
 1. Calculate modeled CH₄ generation the same way as landfills without GCS, subtract the amount of CH₄ recovered by the GCS, and adjust for destruction efficiency of collected gas and soil oxidation of uncollected gas.
 2. Determine CH₄ recovered by the GCS, apply a gas collection efficiency to account for emissions of uncollected gas, and adjust for destruction efficiency of collected gas and soil oxidation of uncollected gas.

Inputs needed for the two emission calculation methods



Method 1: Subtract recovery from CH₄ generation

**Eq. HH-6 to
calculate
emissions**

- Modeled methane generation from Eq. HH-1, (use recovery from Eq. HH-4 if it is larger)
- Methane recovered by GCS from Eq. HH-4
- Destruction efficiency
- Soil oxidation factor

Method 2: Determine recovery and apply collection efficiency

**Eq. HH-8 to
calculate
emissions**

- Methane recovered by GCS from Eq. HH-4
- CE from table HH-3 or 0.75
- Destruction efficiency
- Soil oxidation factor

Measuring CH₄ recovered



- CH₄ recovered by GCS must be determined for both emission calculation methods
 - Continuously monitor gas flow
 - Monitor CH₄ concentration continuously OR measure weekly (allows use of handheld meters)
 - Adjust measurements for temperature, pressure, and moisture
 - See 98.343(b) & Eq. HH-4 for details
- Measure in GCS header prior to destruction device or treatment equipment
 - knockout pots, compressors, blowers, etc are not treatment
- Measure CH₄ concentration near the flow monitor or at a location representative of flow monitor location.

Measuring CH₄ recovered - details



Must determine or measure	In units of	Using the following methods and calibration
Volumetric flow rate of LFG recovered and routed to destruction device	acfm per day (per week if measuring CH ₄ weekly rather than continuously)	Continuous gas flow monitor that meets the 5% accuracy specified in 98.3 (i) of subpart A. Calibrate using methods in 98.344(c) or manufacturer's specified methods.
Temperature, pressure and density (if flow monitor doesn't automatically correct for these)	See Eq. HH-4 term descriptions	Type of monitor not specified, but must meet 5% accuracy specified in 98.3(i). Calibrate as specified by manufacturer and document procedures used to ensure accuracy and document estimated accuracy per 98.344(d) and (e)
Methane concentration	Volume percent [if CH ₄ conc. and flow are measured on different bases (wet vs dry) then correct for moisture]	<ol style="list-style-type: none"> 1. If you have a continuous CH₄ monitor, you must use it and compute daily average CH₄ concentrations. Monitor must use one of the analysis methods in 98.344(b) and be calibrated per 98.344(b). 2. Otherwise, meter the CH₄ concentration at least weekly at a location near or representative of the flow monitor location per 98.343(b)(2)(ii).

Determining destruction efficiency



- Destruction efficiency must be determined for both emission calculation methods.
 - Use combustion device manufacturer's specified destruction efficiency or 0.99 (whichever is less)
 - If gas is transported off-site for destruction, use 1.0. This is because none of the recovered gas is emitted at the landfill.

Determining soil oxidation



- Soil oxidation factor must be determined for both emission calculation methods
- Default value of 10% must be used

Determining Collection Efficiency



- Collection efficiency must be determined for the second emission calculation method (collection efficiency is applied to CH₄ recovered to account for uncollected gas)
- Select collection efficiency (CE) from Table HH-3 based on landfill cover type and presence of active collection system
 - If areas within the landfill differ in terms of cover type or presence of collection system, determine CE for each area and determine overall weighted CE for landfill per equation in Table HH-3)
- If area by cover type is not available, use $CE = 0.75$

Missing data calculation procedures



- CH₄ content and gas flow rate
 - Average of QA'd values immediately before and after missing data period
 - If no “after” value by end of year, use “before” value
 - If no “before” value available, use first QA'd value measured after the missing data period
- For missing daily waste disposal quantity
 - Average value for that day of the week as measured the week before and after the missing daily data.

What must be reported by all landfills?



- Information required by 98.3(c) of subpart A
- Whether landfill is open or closed
- First year it accepted waste
- Last year it accepted waste or planned closure year
- Capacity
- Whether leachate is recirculated
- Waste disposal quantity for each year
- Method used to determine waste disposal quantity
- Waste composition: municipal; biosolids or sludge; more refined waste categories (materials) if available

What must be reported by all landfills (continued)?



- For each waste type used to calculate generation in HH-1, report degradable organic fraction (DOC) and rate (k)
- Fraction of CH_4 in landfill gas and how it was determined
- Surface area containing waste
- Cover types
- Surface area associated with each cover type
- Modeled methane generation rate (Eq. HH-1)

What else do landfills without gas collection systems report?



- Annual methane emissions, metric tons (from Eq. HH-5)

What else do landfills with gas collection systems report?



- Total flow of landfill gas collected for destruction
- CH₄ concentration of gas collected for destruction
- Monthly average temperature and pressure (or statement monitor internally corrects for these)
- Whether destruction occurs at the landfill facility or off-site. If at landfill, operating hours of primary destruction device and backup device and DE used
- Annual quantity of methane recovered (Eq. HH-4)

What else do landfills with gas collection systems report (cont)?



- Description of gas collection system
 - Manufacturer, capacity, number of wells
 - Surface area, waste depth, and cover type for areas within the landfill (as specified in Table HH-3)
 - Estimated gas collection efficiency
 - Annual operating hours of collection system
- Methane generation calculated two ways:
 - Modeled CH_4 generation adjusted for soil oxidation (Eq. HH-5)
 - CH_4 generation calculated from methane recovered and collection efficiency (Eq. HH-7)

What else do landfills with gas collection systems report (cont)?



- Generation value used as input to methane emission calculation in Eq. HH-6 and how it was determined (e.g., from Eq. HH-1 or HH-4)
- Methane emissions calculated using Eq. HH-6 (CH₄ generation minus CH₄ recovered, adjusted for soil oxidation and destruction efficiency)
- Methane emissions calculated using Eq. HH-8 (based on CH₄ recovered and collection efficiency, adjusted for soil oxidation and destruction efficiency)

What must be recorded?



- Information required by 98.3(g) of subpart A
- Calibration records for all monitoring equipment
- Methods or manufacturers specifications used for calibrations

For further information



www.epa.gov/climatechange/emissions/ghgrulemaking.html

- Applicability tool
- Landfill information sheet
- Preamble and rule
- Subpart HH comment response document
- FAQs



Questions?

Appendix



Subpart C (Stationary Fuel Combustion Sources) - Emission Calculation Equations

Equation C-1: CO₂ emissions from each type of fuel in Table C-1

$$CO_2 = 1 \times 10^{-3} * Fuel * HHV * EF$$

Where	Equals	Units	Determined by
CO ₂	Annual CO ₂ mass emissions for the specific fuel type.	Metric tons	Calculating this equation
Fuel	Mass or volume of fuel combusted per year	mass in short tons for solid fuel, volume in standard cubic feet for gaseous fuel, and volume in gallons for liquid fuel	From company records
HHV	Default high heat value of the fuel	mmBtu/ton, mmBtu/scf, or mmBtu/gallon, as applicable	Default value from Table C-1 of subpart C
EF	Fuel-specific default CO ₂ emission factor	kg CO ₂ /mmBtu	Default value from Table C-1 of subpart C
1 x 10 ⁻³	Conversion factor from kilograms to metric tons	Metric ton per kg	(given)

Equation C-1: Tier 1 - CO₂ emissions from each type of fuel in Table C-1

$$CO_2 = 1 \times 10^{-3} * Fuel * HHV * EF$$

Where	Equals	Units	Determined by
CO ₂	Annual CO ₂ mass emissions for the specific fuel type.	Metric tons	Calculating this equation
Fuel	Mass or volume of fuel combusted per year	mass in short tons for solid fuel, volume in standard cubic feet for gaseous fuel, and volume in gallons for liquid fuel	From company records
HHV	Default high heat value of the fuel	mmBtu/ton, mmBtu/scf, or mmBtu/gallon, as applicable	Default value from Table C-1 of subpart C
EF	Fuel-specific default CO ₂ emission factor	kg CO ₂ /mmBtu	Default value from Table C-1 of subpart C
1 x 10 ⁻³	Conversion factor from kilograms to metric tons	Metric ton per kg	(given)

Equation C-2a: Tier 2 - CO₂ emissions from each type of fuel in Table C-1, except for MSW

$$CO_2 = 1 \times 10^{-3} * Fuel * HHV * EF$$

Where	Equals	Units	Determined by
CO ₂	Annual CO ₂ mass emissions for the specific fuel type.	Metric tons	Calculating this equation
Fuel	Mass or volume of fuel combusted per year	mass in short tons for solid fuel, volume in standard cubic feet for gaseous fuel, and volume in gallons for liquid fuel	From company records
HHV	Annual average high heat value of the fuel from all valid samples for the year	mmBtu/ton, mmBtu/scf, or mmBtu/gallon, as applicable	Sampling and analysis of the fuel, either by the facility or by the fuel supplier, at regular periods throughout the reporting year. Frequency depends on the specific type of fuel.
EF	Fuel-specific default CO ₂ emission factor	kg CO ₂ /mmBtu	Default value from Table C-1 of subpart C
1 x 10 ⁻³	Conversion factor from kilograms to metric tons	Metric ton per kg	(given)

Equation C-2b: Annual average high heat value (HHV) calculation

$$(HHV)_{\text{annual}} = \frac{\sum_{i=1}^n (HHV)_i * (Fuel)_i}{\sum_{i=1}^n (Fuel)_i}$$

Where	Equals	Units	Determined by
$(HHV)_{\text{annual}}$	Weighted annual average high heat value of the fuel	mmBtu/ton, mmBtu/scf, or mmBtu/gallon, as applicable	Calculating this equation
$(HHV)_i$	High heat value of the fuel, for month “i”	mmBtu/ton, mmBtu/scf, or mmBtu/gallon, as applicable	Sampling and analysis of the fuel, either by the facility or by the fuel supplier, at regular periods throughout the reporting year. Frequency depends on the specific type of fuel. If multiple HHV determinations are made in any month, average the values for the month arithmetically.
$(Fuel)_i$	Mass or volume of the fuel combusted during month “i”	mass in short tons for solid fuel, volume in standard cubic feet for gaseous fuel, and volume in gallons for liquid fuel	From company records
n	Number of months in the year that fuel is burned in the unit.	(none)	From company records

Equation C-2c: Tier 2 - CO₂ emissions from units that combust MSW (or other types of solid fuel) and that produce steam

$$\text{CO}_2 = 1 \times 10^{-3} \text{ Steam} * \text{B} * \text{EF}$$

Where	Equals	Units	Determined by
CO ₂	Annual CO ₂ mass emissions from MSW or other solid fuel combustion.	Metric tons	Calculating this equation
Steam	Total mass of steam generated by MSW or solid fuel combustion during the reporting year).	lb steam	From company records
B	Ratio of the boiler's maximum rated heat input capacity to its design rated steam output capacity	mmBtu/lb steam	From company records
EF	Fuel-specific default CO ₂ emission factor	kg CO ₂ /mmBtu	Default value from Table C-1 of subpart C
1 x 10 ⁻³	Conversion factor from kilograms to metric tons	Metric ton per kg	(given)

Equation C-3: Tier 3 - CO₂ emissions from units that combust solid fuel

$$CO_2 = \frac{44}{12} * Fuel * CC * 0.91$$

Where	Equals	Units	Determined by
CO ₂	Annual CO ₂ mass emissions from the combustion of the specific solid fuel.	Metric tons	Calculating this equation
Fuel	Annual mass of the solid fuel combusted	Short tons	From company records
CC	Annual average carbon content of the solid fuel (percent by weight, expressed as a decimal fraction, e.g., 95 percent = 0.95)	kg C/kg fuel	From analysis of fuel samples and calculated using the same method as for HHV in Eq. C-2b
44/12	Ratio of molecular weights, CO ₂ to carbon.	kg CO ₂ /kg C	(given)
0.91	Conversion factor from short tons to metric tons	Metric ton per short ton	(given)

Equation C-4: Tier 3 - CO₂ emissions from units that combust liquid fuel

$$\text{CO}_2 = \frac{44}{12} * \text{Fuel} * \text{CC} * 0.001$$

Where	Equals	Units	Determined by
CO ₂	Annual CO ₂ mass emissions from the combustion of the specific liquid fuel.	Metric tons	Calculating this equation
Fuel	Annual volume of the liquid fuel combusted.	Gallons	Using calibrated fuel flow meters [see §98.3(i) in subpart A], fuel billing meters, or tank drop measures.
CC	Annual average carbon content of the liquid fuel.	kg C/gallon fuel	From analysis of fuel samples and calculated using the same method as for HHV in Eq. C-2b
44/12	Ratio of molecular weights, CO ₂ to carbon.	kg CO ₂ /kg C	(given)
0.001	Conversion factor from kg to metric tons	Metric ton per kg	(given)

Equation C-5: Tier 3 - CO₂ emissions from units that combust gaseous fuel

$$CO_2 = \frac{44}{12} * Fuel * CC * \frac{MW}{MVC} * 0.001$$

Where	Equals	Units	Determined by
CO ₂	Annual CO ₂ mass emissions from the combustion of the specific gaseous fuel.	Metric tons	Calculating this equation
Fuel	Annual volume of the gaseous combusted.	scf	Using calibrated fuel flow meters [see §98.3(i) in subpart A], or fuel billing meters.
CC	Annual average carbon content of the gaseous fuel (percent by weight, expressed as a decimal fraction, e.g., 86 percent = 0.86).	kg C/kg fuel	From analysis of fuel samples and calculated using the same method as for HHV in Eq. C-2b
MW	Annual average molecular weight of the gaseous fuel.	kg/kg-mole	From analysis of fuel samples and calculated using the same method as for HHV in Eq. C-2b
MVC	Molar volume conversion factor (849.5 scf per kg-mole at standard conditions, as defined in §98.6 in subpart A).	scf per kg-mole	(given)
44/12	Ratio of molecular weights, CO ₂ to carbon.	kg CO ₂ /kg C	(given)
0.001	Conversion factor from kg to metric tons	Metric ton per kg	(given)

Equation C-6: Tier 4 - Hourly CO₂ emissions from units that measure CO₂ concentration on a wet basis

$$CO_2 = 5.18 \times 10^{-7} * C_{CO_2} * Q$$

Where	Equals	Units	Determined by
CO ₂	CO ₂ mass emission rate	Metric tons/hr	Calculating this equation
C _{CO₂}	Hourly average CO ₂ concentration	% CO ₂ by volume	Using a CO ₂ monitor certified in accordance with 40 CFR part 75, part 60, or an applicable State continuous monitoring program.
Q	Hourly average stack gas volumetric flow rate	scfh	Using a gas flow rate monitor certified in accordance with 40 CFR part 75, part 60, or an applicable State continuous monitoring program.
5.18 x 10 ⁻⁷	Conversion factor	metric tons/scf/% CO ₂	(given)

Equation C-7: Correction to CO₂ concentration measured on a dry basis for stack gas moisture content

$$CO_2^* = CO_2 \left(\frac{100 - \%H_2O}{100} \right)$$

Where	Equals	Units	Determined by
CO ₂ *	Hourly CO ₂ mass emission rate, corrected for moisture	Metric tons/hr	Calculating this equation
CO ₂	Hourly CO ₂ mass emission rate from Equation C-6 of the rule, uncorrected for moisture content if measured on a dry basis.	Metric tons/hr	Calculating Equation C-6
%H ₂ O	Hourly moisture percentage in the stack gas	% H ₂ O by volume	Monitoring the stack gas moisture content as described in §75.11(b)(2) of part 75 or, for certain types of fuel, using a default moisture percentage from §75.11(b)(1) of part 75.

Equation C-8: CH₄ and N₂O mass emissions from fuel combustion in units using Tiers 1 or 3 to calculate CO₂ emissions

$$CH_4 \text{ or } N_2O = 1 \times 10^{-3} * Fuel * HHV * EF$$

Where	Equals	Units	Determined by
CH ₄ or N ₂ O	Annual CH ₄ or N ₂ O mass emissions from the combustion of a particular type of fuel	Metric tons	Calculating this equation
Fuel	Mass or volume of fuel combusted per year	mass in short tons for solid fuel, volume in standard cubic feet for gaseous fuel, and volume in gallons for liquid fuel	From company records or directly measured by a fuel flow meter, as applicable
HHV	Default high heat value of the fuel	mmBtu/ton, mmBtu/scf, or mmBtu/gallon, as applicable	From Table C-1.
EF	Fuel-specific default emission factor for CH ₄ and N ₂ O emissions	kg CH ₄ or N ₂ O per mmBtu	Default value from Table C-2 of subpart C
1 x 10 ⁻³	Conversion factor from kilograms to metric tons	Metric ton per kg	(given)

Equation C-9a: CH₄ and N₂O mass emissions from fuel combustion in units using Tier 2 to calculate CO₂ emissions

$$CH_4 \text{ or } N_2O = 1 \times 10^{-3} * Fuel * HHV * EF$$

Where	Equals	Units	Determined by
CH ₄ or N ₂ O	Annual CH ₄ or N ₂ O mass emissions from the combustion of a particular type of fuel	Metric tons	Calculating this equation
Fuel	Mass or volume of fuel combusted per year	mass in short tons for solid fuel, volume in standard cubic feet for gaseous fuel, and volume in gallons for liquid fuel	From company records or directly measured by a fuel flow meter, as applicable
HHV	Annual average high heat value of the fuel from all valid samples for the year	mmBtu/ton, mmBtu/scf, or mmBtu/gallon, as applicable	Sampling and analysis of the fuel, either by the facility or by the fuel supplier, at regular periods throughout the reporting year, depending on the specific type of fuel. This is the same annual average HHV used to calculate CO ₂ emissions using Tier 2 and is calculated using equation C-2b in the rule.
EF	Fuel-specific default emission factor for CH ₄ and N ₂ O emissions	kg CH ₄ or N ₂ O per mmBtu	Default value from Table C-2 of subpart C
1 x 10 ⁻³	Conversion factor from kilograms to metric tons	Metric ton per kg	(given)

Equation C-9b: CH₄ and N₂O mass emissions from fuel combustion in units that combust MSW (or other types of solid fuel) and that produce steam

$$CH_4 \text{ or } N_2O = 1 \times 10^{-3} * Steam * B * EF$$

Where	Equals	Units	Determined by
CH ₄ or N ₂ O	Annual CH ₄ or N ₂ O mass emissions from the combustion of the solid fuel (MSW or other solid fuels).	Metric tons	Calculating this equation
Steam	Total mass of steam generated by MSW or solid fuel combustion during the reporting year.	lb steam	From company records
B	Ratio of the boiler's maximum rated heat input capacity to its design rated steam output capacity	mmBtu/lb steam	From company records
EF	Fuel-specific default CH ₄ or N ₂ O emission factor	kg CH ₄ or N ₂ O /mmBtu	Default value from Table C-2 of subpart C
1 x 10 ⁻³	Conversion factor from kilograms to metric tons	Metric ton per kg	(given)

Equation C-10: CH₄ and N₂O mass emissions from fuel combustion in units that are subject to the ARP reporting requirements, units who monitor their heat input on a year-round basis according to 40 CFR part 75, and units that use Tier 4 to measure CO₂ emissions

$$CH_4 \text{ or } N_2O = 0.001 * (HI)_A * EF$$

Where	Equals	Units	Determined by
CH ₄ or N ₂ O	Annual CH ₄ or N ₂ O mass emissions from the combustion of a particular type of fuel.	Metric tons	Calculating this equation
(HI) _A	Cumulative annual heat input from the fuel	mmBtu	From the electronic data report filed under §75.64 of part 75
EF	Fuel-specific default CH ₄ or N ₂ O emission factor	kg CH ₄ or N ₂ O /mmBtu	Default value from Table C-2 of subpart C
0.001	Conversion factor from kilograms to metric tons	Metric ton per kg	(given)

Equation C-11: CO₂ mass emissions from use of carbon-containing sorbent to control acid gas emissions

$$CO_2 = 0.91 * S * R * \left(\frac{MW_{CO_2}}{MW_S} \right)$$

Where	Equals	Units	Determined by
CO ₂	Annual CO ₂ mass emissions from carbon containing sorbent for the reporting year.	Metric tons	Calculating this equation
S	Limestone or other carbon containing sorbent used in the reporting year	Short tons	From company records
R	1.00, the calcium to acid species stoichiometric ratio	mole Ca to mole S	(Given)
MW _{CO₂}	Molecular weight of CO ₂ , 44	g/mole	(Given)
MW _S	Molecular weight of sorbent, 100 if sorbent is calcium carbonate	g/mole	From company records on type of sorbent
0.91	Conversion factor from short tons to metric tons	Metric ton per short ton	(given)

Appendix



Reporting requirements of Subpart C if CEMS used (98.36(b) and 98.36(e)(2)(vi)):

- Unit ID
- Maximum rated heat input capacity of unit
- Types of fuels combusted
- Annual CO₂ emissions from combustion of fossil fuels combined, in metric tons
- Annual CO₂ emissions from combustion of biomass fuels combined (if applicable), in metric tons
- Annual CH₄ and N₂O emissions for each type of fuel combusted, in metric tons of each gas and CO₂e
- Annual CO₂ emissions from sorbent if wet FGD or sorbent injection is used, in metric tons
- Annual GHG emissions from all fossil fuels combined burned in the unit, in metric tons CO₂e
- Customer meter number if natural gas combusted
- Operating hours per year.
- CO₂ mass emissions per quarter, in metric tons.
- Percentage of operating hours using a substitute data value in the emissions calculations